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(71) Applicant
Thomas McNiven
c/o Taskframe Limited, Unit 1,
Dean Clough Industrial Park, Halifax,
West Yorkshire HX3 5AX

(72) Inventor
Thomas McNiven

(74) Agent and/or Address for Service
Urquart-Dykes & Lord
5th Floor, Tower House, Merrion Way, Leeds LS2 8PA
West Yorkshire

(51) INT CL'
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(58) Field of search
F1D
Selected US specifications from IPC sub-classes
F15B B66F

(54) Improvements in and relating to inflatable bags

(57) An inflatable bag 1, particularly for lifting heavy loads, comprises a plurality of chambers 2, 3, 4 each comprising a pair of flexible sheets 2a, 2b, 3a, 3b, and 4a, 4b, each sheet having a central aperture therein. The separate sheets are welded together, and the bag is provided with an inlet valve 8, an outlet valve 9 and a pressure relief valve 10, the bag being inflated by introducing compressed air or other suitable inflating medium through inlet valve 8.

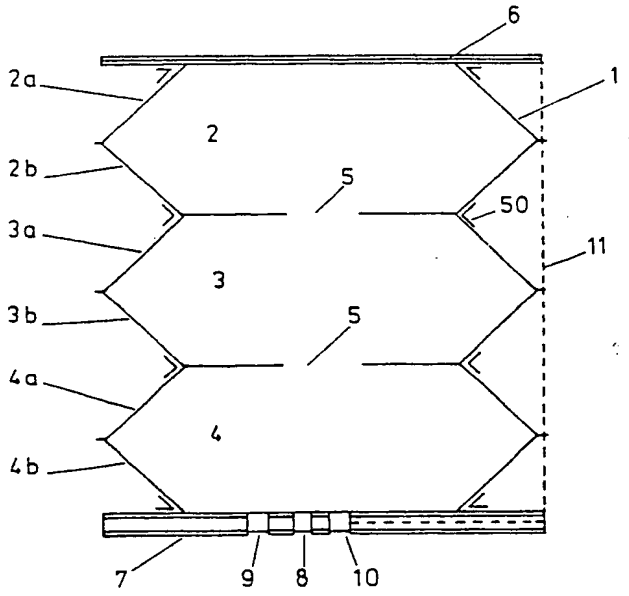

FIG. 1

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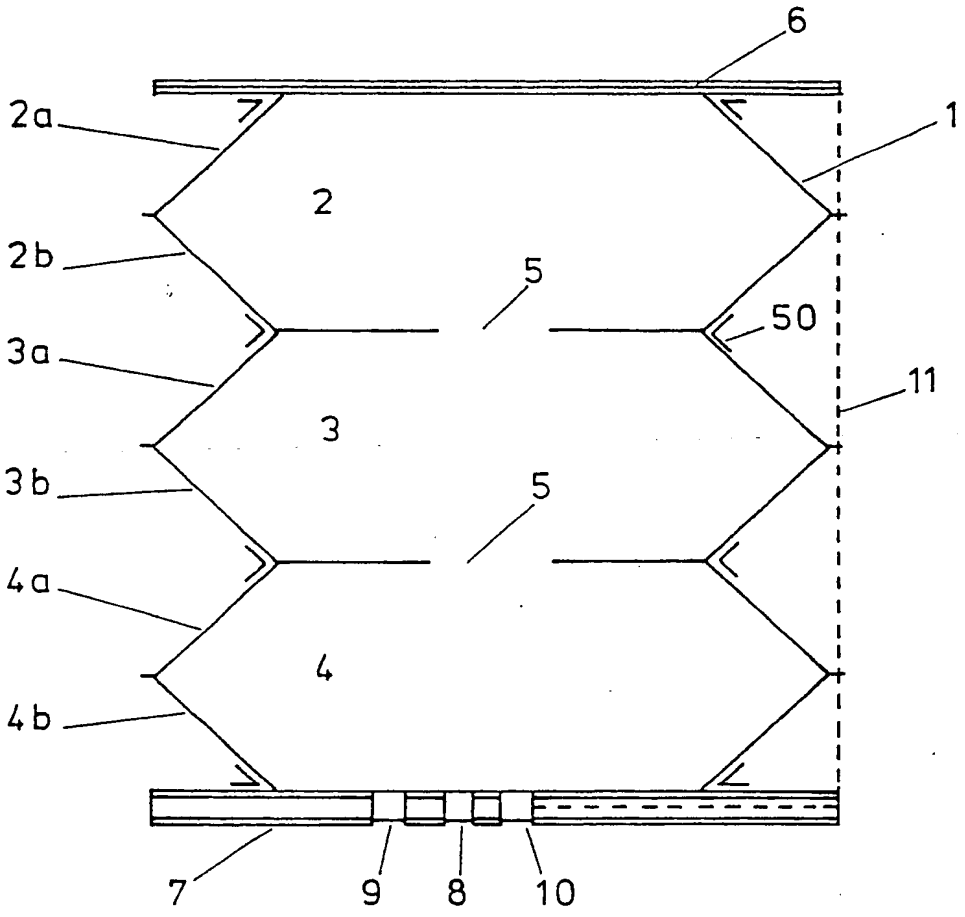

FIG. 1

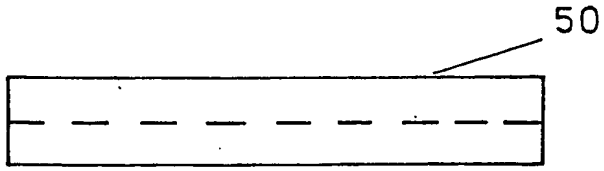

FIG 1A

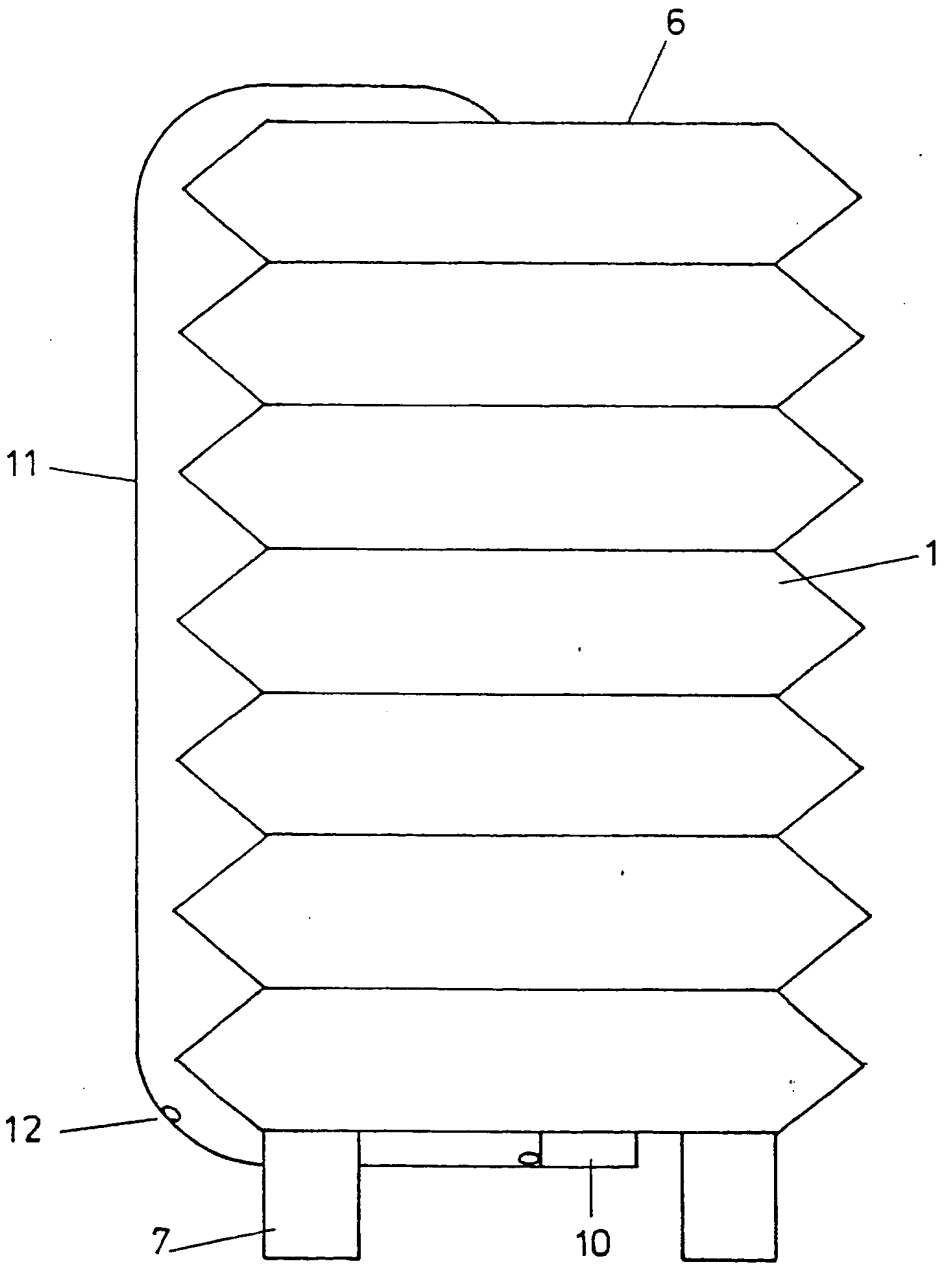

FIG 2

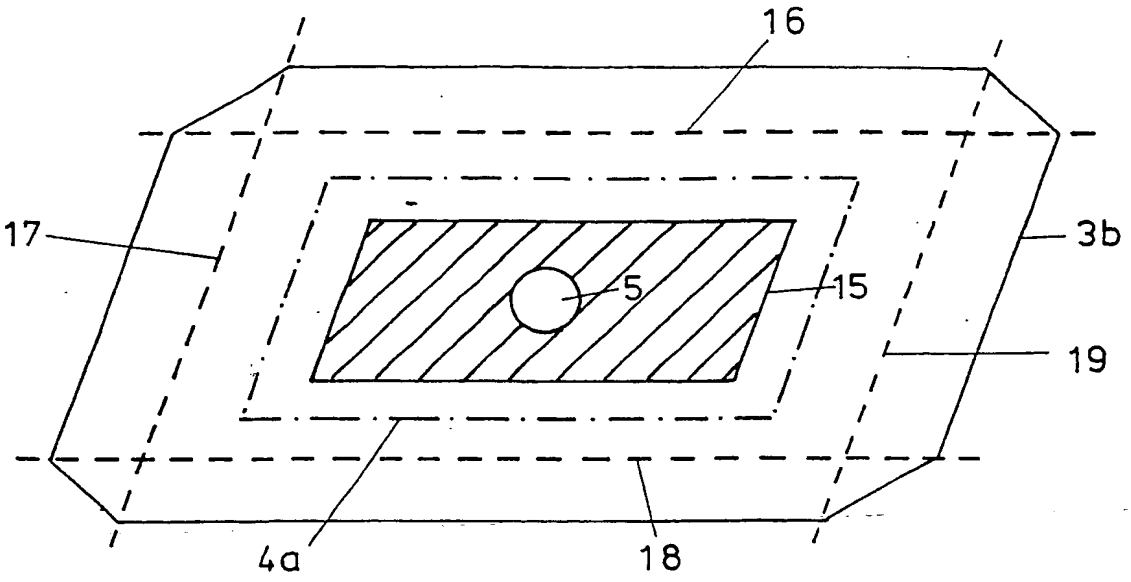

FIG. 3

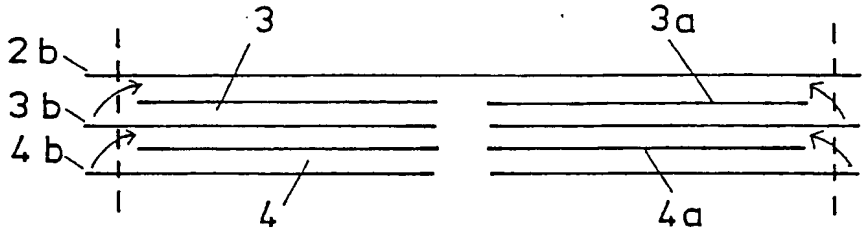

FIG. 4

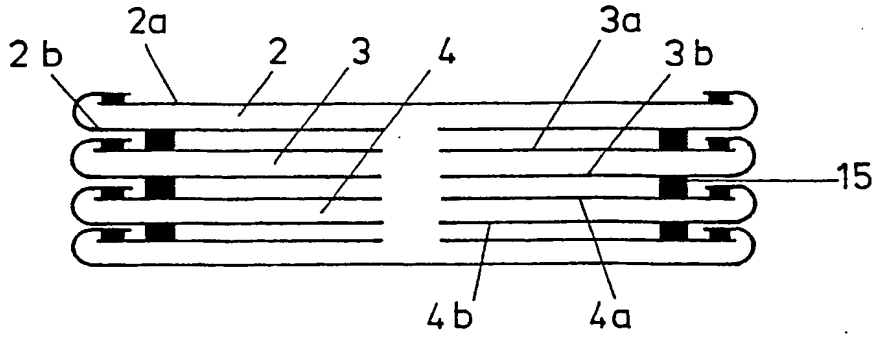

FIG. 5

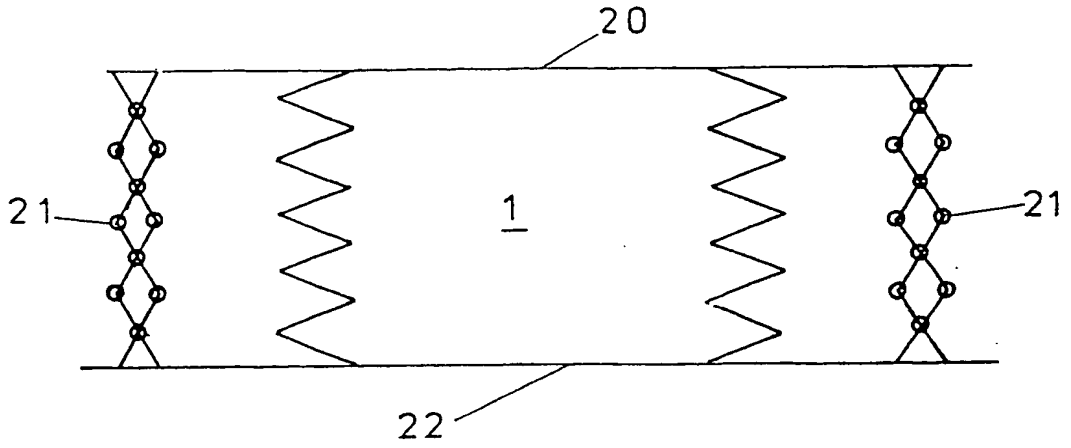

FIG. 6

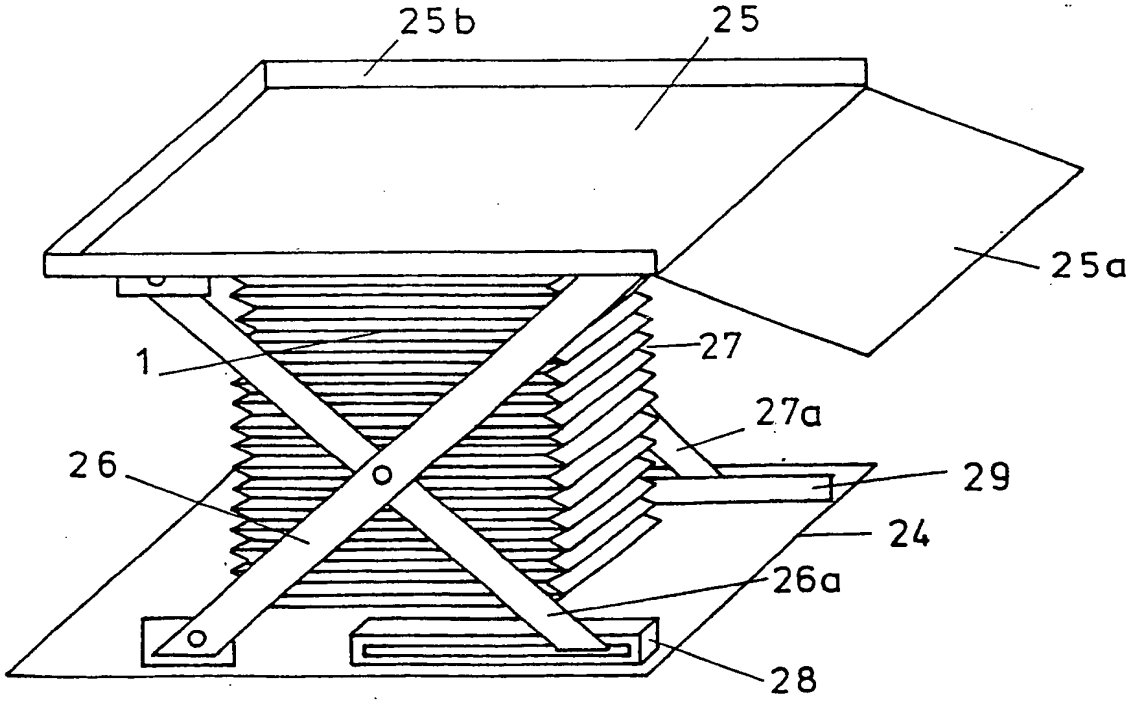

FIG. 7

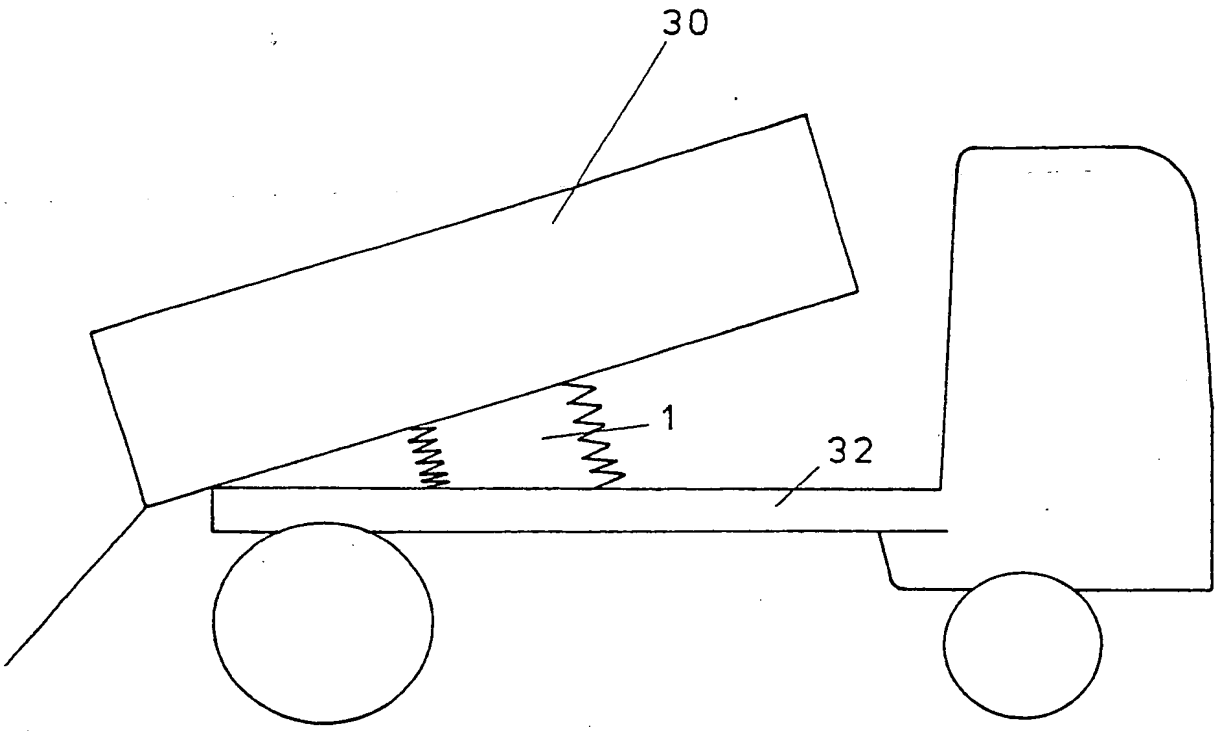

FIG. 8

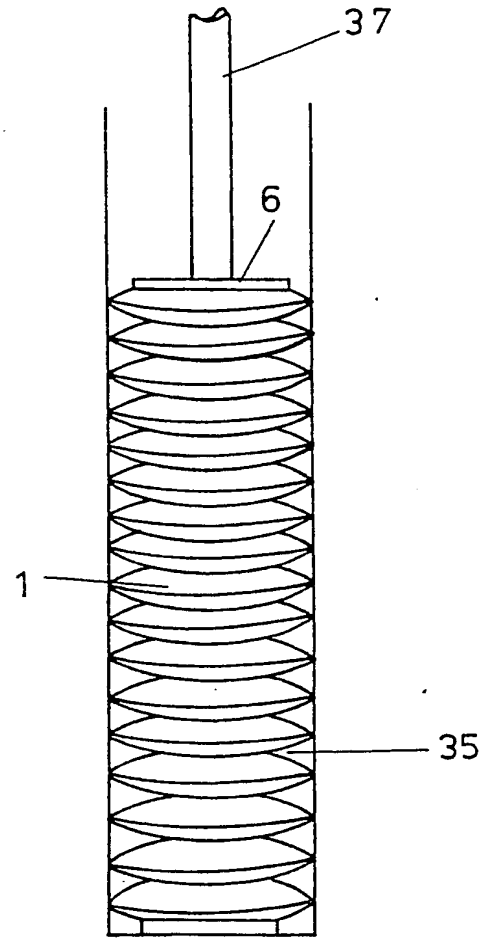

FIG. 9

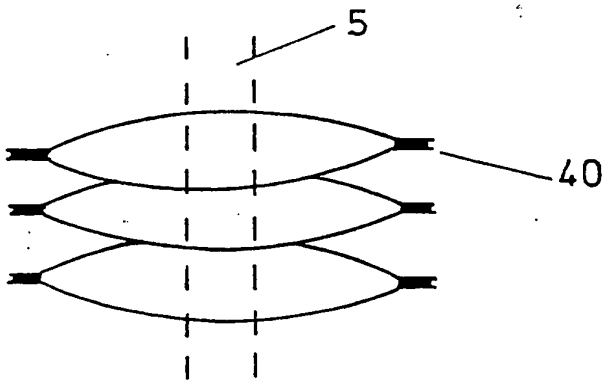

FIG. 10

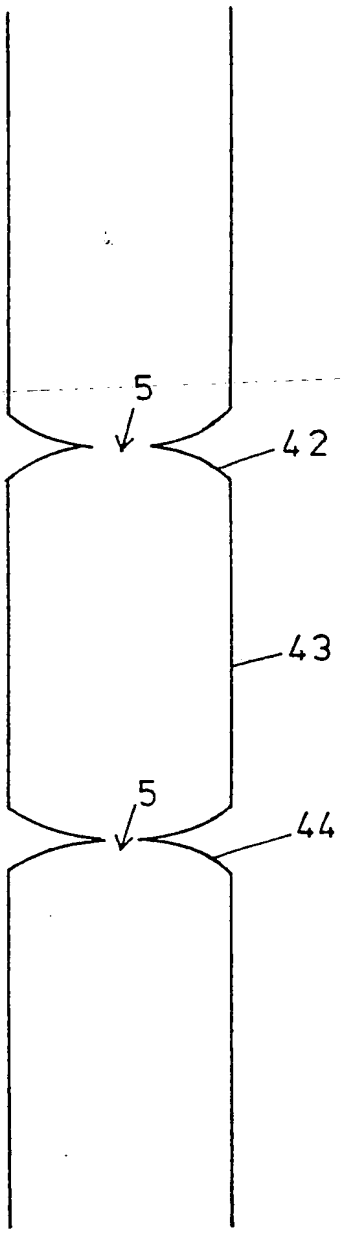

FIG. 11

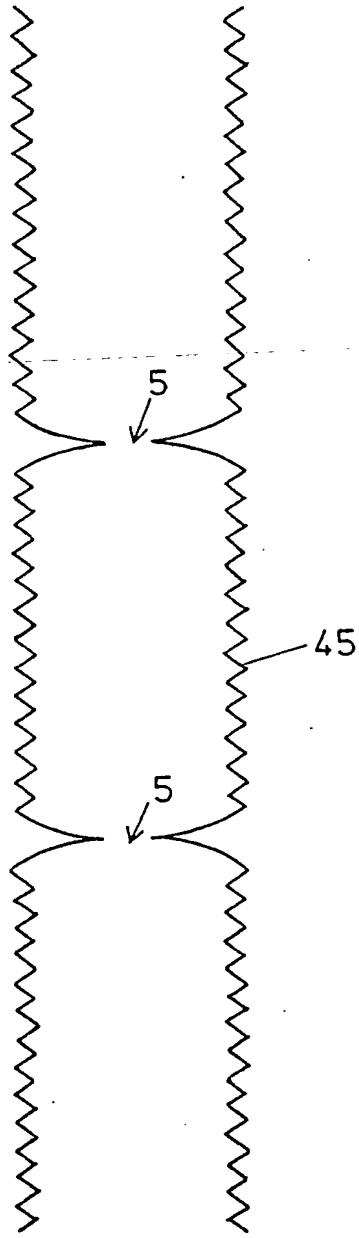

FIG. 12

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IMPROVEMENTS IN AND RELATING TO INFLATABLE BAGS

The present invention relates to an improved inflatable bag which may be used in any one of a number of different applications, for example, the lifting of heavy objects such as wagons, locomotives, and aeroplanes, and to a method of manufacturing such an inflatable bag.

Various designs in inflatable bags have been proposed, but none of these conventional designs are totally acceptable in terms of maximum operating pressures and degree of stability or control during inflation and deflation.

According to a first aspect of the present invention there is provided an inflatable bag comprising at least two superimposed inflatable chambers, means for introducing fluid into one of said chambers, and at least one aperture defined between said two chambers whereby introduction of fluid into one of the chambers results in inflation of both of said at least two chambers.

Preferably, there is provided a plurality of such chambers arranged in stacked, superimposed relationship between two support members, such that the bag may be stood on the ground or a flat surface with a load supported on the other support member.

The support members may both be in the form of a relatively thin but rigid sheet or plate, but in the case of the lower support member this may take the form of an elongate box-shaped structure which extends around the periphery of the bag. The rigid sheet or plate on top of the bag serves to provide a flat surface and to prevent the top chamber from assuming a domed shape.

Conveniently, the bag is also provided with an outlet valve which can be opened to deflate the bag, and, in a preferred embodiment, the bag is also provided with a pressure relief valve of suitable type, for xample a

"Seetru" valve, which limits the pressure in the bag to prevent damage to the bag itself resulting from over inflation.

Preferably, there is provided height restraining means in the form of a flexible elongate member attached at one end thereof to the pressure relief valve which is located beneath the lowest chamber, and attached at the other end to the top of the uppermost chamber, such that when the bag is fully inflated the flexible elongate member is pulled taut. Further inflation creates a pulling force on the pressure relief valve which is then caused to open slightly to release the excess fluid, thus limiting the height of the inflated bag.

The bag may be inflated using any suitable fluid medium, for example compressed air, bottle gases, exhaust gases or even a liquid fluid such as water, the latter being particularly suitable if the lifting device is to be used in off-shore applications.

Although the bag is primarily intended to raise loads vertically, it could equally be used to push loads horizontally or as a compressing device.

During inflation, and particularly when the bag is being inflated under load, the construction of the bag is such that all of the chambers will inflate substantially simultaneously, giving a much greater degree of control and stability.

In the preferred embodiment, each chamber comprises a pair of separate, flexible sheets joined to each other around the periphery thereof to provide an envelope, each sheet having a central aperture therein, these apertures being aligned in the assembled bag.

The sheets may be rectangular, square, circular or any other desired shape, and are preferably cut from any weldable material such as polyurethane coated woven fabric, polyamide, "Nylon" or "Kevlar". With such materials,

joining of the sheets can conveniently be achieved by means of radio frequency welding techniques.

According to a second aspect of the present invention there is provided a method of manufacturing an inflatable bag, comprising constructing at least two inflatable chambers, joining said chambers together in superimposed relationship, and providing at least one aperture between said at least two inflatable chambers.

The joining of the sheets may be carried out in either of two ways. A simple peel joint may be used, in which case the sheets are aligned and are simply welded together around their outer edges. This provides an adequate weld, but an even stronger weld is provided by a lap joint which is achieved by one of each pair of the sheets being larger than the other. The smaller sheet of one pair is welded to the underside of the larger sheet of an adjacent pair around the central aperture, and the edges of the upper, larger sheet are folded upwards and inwards to provide creases or fold lines. These folded edges of the larger sheet are then welded to the edges of the smaller sheet of the same pair, thus creating a lap joint which is much stronger and could be expected to withstand pressures in excess of 2 bar.

The above described construction of air bag is able to withstand high internal pressures (up to 2 bar or more), and can be inflated and deflated in a highly controlled manner.

An added advantage is that should a hole or puncture occur in one of the chambers, that chamber will deflate rapidly until the adjacent chambers close together, thus sealing the hole or puncture.

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which;

Figure 1 is a longitudinal cross-section through an

inflatable bag of the present invention;

Figure 2 illustrates the operation of the height restraining means and pressure relief valve;

Figures 3, 4 and 5 illustrate the formation of a welded lap joint;

Figure 6 illustrates the use of the bag in a scissor platform;

Figure 7 illustrates the use of the bag in a lifting table;

Figure 8 illustrates the use of the bag to tip a platform relative to a chassis of a trailer or vehicle;

Figure 9 illustrates an alternative embodiment of the invention;

Figure 10 illustrates the method of joining used in the embodiment of Figure 9;

Figures 11 and 12 illustrate further embodiments of the invention.

Referring to the drawings, an inflatable bag 1 comprises a plurality of chambers 2,3,4, each defined by a pair of sheets 2a, 2b, 3a, 3b and 4a, 4b of weldable fabric, such as polyurethane coated woven fabric, polyamide, "Nylon", or "Kevlar"(RTM). Each sheet, which may be rectangular, square, circular or any other desired shape, has a central aperture 5 therein.

The top chamber 5 has a top plate 6 fixed thereto, this top plate preferably taking the form of a rigid metal plate which is enclosed within one of the sheets of material. However, the top plate 6 may equally be a rigid plastic plate or even a flexible member, and does not have to be enclosed within the flexible sheet.

The bottom chamber 4 has fixed thereto and is supported by a rigid plate 7 which preferably is in the form of a rectangular or square frame of square box cross-section, such that the base of the bag is located slightly above the ground, to prevent damage to the inlet valve

described below.

The bottom chamber 4 is also provided with an inlet valve 8, an outlet valve 9 and a pressure relief valve 10, for example a "Seetru" valve.

In use, compressed air or other suitable inflating fluid is fed in through inlet valve 8, admitting air to all three chambers 2, 3 and 4. Once the bag has reached full inflation, the height control cable 11 comes into operation. This cable or cord is attached at one end to the pressure relief valve 10 and at the other end to the top plate 6, passing over a pulley or roller 12. At full inflation, the cable 11 is taut, and any further inflation of the bag will cause the cable to pull on pressure relief valve 10 thus causing it to open and the excess pressure is thereby released, resulting in a slight deflation of the bag. Hence the bag cannot be overinflated.

Referring to Figures 3, 4 and 5, these illustrate how a particularly strong lap joint can be achieved between the sheets of each chamber.

Each pair of sheets comprises a larger sheet and a smaller sheet. A smaller sheet 4a of one pair is welded to the underside of a larger sheet 3b of an adjacent pair, either by a line weld 15, or alternatively the whole area shown shaded in Figure 3 may be welded. In order to reinforce the weld between sheets 4a and 3b, a piece of reinforcing material 50 is welded into the joint, the piece of material first having been folded along line 50 as shown in Figure 1A. This prevents the joint from peeling, and is provided at each joint between the chambers and also between the top chamber and the top plate 6 and between the bottom chamber and the bottom support member 7.

The edges of the upper larger sheet 3b are then folded upwards and inwards to create fold lines 16, 17, 18 and 19, and the corners of the sheet are cut off. These folded edges of larger sheet 3b are then brought into contact with

and welded to the edges of the smaller sheet 3a of that pair, as shown in Figures 4 and 5, to create chamber 3.

The inflatable air bag of the present invention may be used in any one of a large number of different applications, a selection of which are illustrated in Figures 6, 7, 8 and 9.

Referring to Figure 6, by placing the bag between two platforms 20, 22 connected together by scissor supports 21, a scissor platform can be created.

In Figure 7, a lifting table comprises a base 24 and a platform 25 separated by a pair of pivotable X-shaped links 26, 27, the air bag 1 being located between the pairs of links. As the bag is inflated, link members 26a, 27a slide along slots in hollow box section supports 28, 29. The table has a ramp 25a for allowing the load to be slid onto the platform, and a raised edge 25b to prevent the load from falling off the platform.

Figure 8 illustrates the use of the bag to raise a tippable platform 30 relative to the chassis 32 of a vehicle or trailer body. Conveniently, the airbag may be inflated by exhaust gases by connecting the inlet valve of the bag up to exhaust pipe of the vehicle. Due to the particular construction of the bag, it will tend to inflate along an arc as shown in Figure 8.

Figure 9 illustrates the use of an alternative embodiment of the invention as an alternative to a conventional hydraulic or phneumatic ram. Sheets of material forming the chambers are welded together at 40 and are supported within a hollow post 35, the top plate 6 having connected thereon a rigid strut 37.

Figure 11 illustrates an alternative embodiment in which each chamber comprises upper and lower walls 42, 44 which are each welded to a cylindrical, elongated body wall 43. In Figure 12, the body wall 45 of each chamber is folded or corrugated in bellows-like fashion to improve the

degree of control during inflation and deflation.

CLAIMS

1. An inflatable bag comprising at least two superimposed inflatable chambers, means for introducing fluid into one of said chambers, and at least one aperture defined between said at least two chambers whereby introduction of fluid into one of the chambers results in the inflation of both of said at least two chambers.

2. An inflatable bag according to Claim in which there is provided a plurality of inflatable chambers arranged in stacked, superimposed relationship between two support members.

3. An inflatable bag according to Claim 1 or Claim 2 in which the bag is also provided with an outlet valve for deflation of the bag.

4. An inflatable bag according to any of preceding Claims in which the bag is also provided with a pressure relief valve.

5. An inflatable bag according to Claim 4 in which there is provided height restraining means in the form of a flexible elongate member attached at one end thereof to the pressure relief valve which is located beneath the lowest chamber, and attached at the other end to the top of the uppermost chamber.

6. An inflatable bag according to any of the preceding Claims in which each chamber comprises a pair of separate, flexible sheets joined to each other around the periphery thereof to provide an envelope, each sheet having a central aperture therein.

7. A method of manufacturing an inflatable bag, the method comprising constructing at least two inflatable chambers, joining said chambers together in superimposed relationship, and providing at least one aperture between said at least two inflatable chambers.

8. An inflatable bag according to Claim 1 and

substantially as herein described and illustrated in the accompanying drawings.

9. A method of manufacturing an inflatable bag, the method being in accordance with Claim 8 and substantially as herein described and illustrated with reference to the accompanying drawings.

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